

WHAT IS CLAIMED IS:

1. In reliable data transfer in which, when data  
is transferred from an initiator to a target, the data  
received by said target is checked for a communication  
error by using an error check code attached to said  
5 data, a transfer status indicating whether said  
communication error occurs is returned from said target  
to said initiator, and, if a transfer error occurring  
during said data transfer is detected by said transfer  
10 status, said initiator retries to transfer said data to  
said target,

a data transfer method for logical records that  
are units of said data transfer between said initiator  
and said target, whereby:

15 a plurality of said logical records in a block  
are batch transferred;

said initiator confirms said transfer status at  
every said batch transfer;

each said logical record is transferred by a  
20 transfer request issued by said initiator; and

for each said logical record that meets a  
predetermined batch transfer condition, said target  
posts a completion status corresponding to said  
transfer request for said logical record to a  
25 completion queue existing in said target upon correct  
reception of said logical record.

2. In reliable data transfer in which, when data

is transferred from an initiator to a target, the data received by said target is checked for a communication error by using an error check code attached to said data, a transfer status indicating whether said communication error occurs is returned from said target to said initiator, and, if a transfer error occurring during said data transfer is detected by said transfer status, said initiator retries to transfer said data to said target,

10 a data transfer method for logical records that are units of said data transfer between said initiator and said target, whereby:

a plurality of said logical records in a block are batch transferred;

15 each said logical record is transferred by a transfer request issued by said initiator and, upon correct arrival of the record on said target, said target posts a completion status corresponding to said transfer request for said logical record to a completion queue existing in said target;

20 said initiator confirms said transfer status at every said batch transfer; and

25 if said target detects a transfer error of said logical record in the middle of said batch transfer by said error check code, said target negates the reception of and stops posting said completion status of the logical record and subsequent logical records until said batch transfer terminates.

3. In reliable data transfer in which, when data is transferred from an initiator to a target, the data received by said target is checked for a communication error by using an error check code attached to said data, a transfer status indicating whether said communication error occurs is returned from said target to said initiator, and, if a transfer error occurring during said data transfer is detected by said transfer status, said initiator retries to transfer said data to said target;

a data transfer method for logical records that are units of said data transfer between said initiator and said target, whereby:

a plurality of said logical records in a block are batch transferred;

said initiator confirms said transfer status at every said batch transfer;

when each said logical record transferred by a transfer request issued by said initiator arrives correctly on said target, said target posts a completion status corresponding to said transfer request for said logical record to a completion queue existing in said target; and

if said target detects a transfer error of said logical record in the middle of said batch transfer by said error check code, said target negates the reception of and stops posting said completion status.

of the logical record and subsequent logical records that are not permitted for reception by a value specified in a batch transfer condition field until said batch transfer terminates.

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4. The data transfer method as recited in claim 1, wherein, if one or more transfer errors are detected during said batch transfer between said initiator and said target, said target includes the ID of the earliest logical record in which a transfer error has been detected in said transfer status which is confirmed at every said batch transfer; and

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said initiator starts a transfer retry from the logical record in which the transfer error occurred, based on said transfer status.

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5. The data transfer method as recited in claim 1, wherein, if one or more transfer errors are detected during said batch transfer between said initiator and said target, said target includes a list of the IDs of the logical records in which a transfer error has been detected in said transfer status which is confirmed at every said batch transfer; and

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said initiator retries transfer of the logical records in which the transfer error occurred, based on said list.

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6. The data transfer method as recited in claim

1, wherein, in the middle of said batch transfer, said initiator or said target can stop said batch transfer by issuing a cancel request.

5           7. A disk control unit comprising a plurality of host interface units interfacing with a host computer and a plurality of disk interface units interfacing with disk drive equipment, each said host interface unit including a memory for temporary storage of data  
10       that said host computer reads or writes, wherein data transfer is performed between said memory and said host computer, each said disk interface unit including a cache memory for temporary storage of data that said disk drive equipment reads or writes, wherein data  
15       transfer is performed between said memory and said disk drive equipment,

          wherein a data transfer method

          which;, in reliable data transfer in which, when  
20       data is transferred from an initiator to a target, the data received by said target is checked for a communication error by using an error check code attached to said data, a transfer status  
          indicating whether said communication error occurs is returned from said target to said  
25       initiator, and, if a transfer error occurring during said data transfer is detected by said transfer status, said initiator retries to transfer said data to said target,

is for logical records that are units of said data transfer between said initiator and said target, whereby:

5 a plurality of said logical records in a block are batch transferred;

said initiator confirms said transfer status at every said batch transfer;

each said logical record is transferred by a transfer request issued by said initiator; and

10 for each said logical record that meets a predetermined batch transfer condition, said target posts a completion status corresponding to said transfer request for said logical record to a completion queue existing in said target upon correct  
15 reception of said logical record;;

is applied to data transfer between said plurality of host interface units and said plurality of disk interface units.

20 8. A disk control unit comprising a plurality of host interface units interfacing with a host computer and a plurality of disk interface units interfacing with disk drive equipment, each said host interface unit including a memory for temporary storage of data  
25 that said host computer reads or writes, wherein data transfer is performed between said memory and said host computer, each said disk interface unit including a cache memory for temporary storage of data that said

disk drive equipment reads or writes, wherein data transfer is performed between said memory and said disk drive equipment,

wherein a data transfer method,

5       which;, in reliable data transfer in which, when data is transferred from an initiator to a target, the data received by said target is checked for a communication error by using an error check code attached to said data, a transfer status  
10       indicating whether said communication error occurs is returned from said target to said initiator, and, if a transfer error occurring during said data transfer is detected by said transfer status, said initiator retries to  
15       transfer said data to said target,  
is for logical records that are units of said data transfer between said initiator and said target, whereby:

20       a plurality of said logical records in a block are batch transferred;

      said initiator confirms said transfer status at every said batch transfer;

      each said logical record is transferred by a transfer request issued by said initiator; and

25       for each said logical record that meets a predetermined batch transfer condition, said target posts a completion status corresponding to said transfer request for said logical record to a

completion queue existing in said target upon correct reception of said logical record;;

is applied to data transfer across said plurality of host interface units.

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9. A disk control unit comprising a plurality of host interface units interfacing with a host computer and a plurality of disk interface units interfacing with disk drive equipment, each said host interface unit including a memory for temporary storage of data that said host computer reads or writes, wherein data transfer is performed between said memory and said host computer, each said disk interface unit including a cache memory for temporary storage of data that said disk drive equipment reads or writes, wherein data transfer is performed between said memory and said disk drive equipment,

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wherein a data transfer method,

which;; in reliable data transfer in which, when

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data is transferred from an initiator to a target, the data received by said target is checked for a communication error by using an error check code attached to said data, a transfer status indicating whether said communication error occurs is returned from said target to said initiator, and, if a transfer error occurring during said data transfer is detected by said transfer status, said initiator retries to

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transfer said data to said target,  
is for logical records that are units of said  
data transfer between said initiator and said  
target, whereby:

5           a plurality of said logical records in a block  
are batch transferred;

          said initiator confirms said transfer status at  
every said batch transfer;

          each said logical record is transferred by a  
10       transfer request issued by said initiator; and

          for each said logical record that meets a  
predetermined batch transfer condition, said target  
posts a completion status corresponding to said  
transfer request for said logical record to a  
15       completion queue existing in said target upon correct  
reception of said logical record;;

          is applied to data transfer across said plurality  
of disk interface units.

20           10. A disk control unit comprising a plurality  
of host interface units interfacing with a host  
computer, a plurality of disk interface units  
interfacing with disk drive equipment, a plurality of  
memory units, and a plurality of processor units,  
25       wherein said host interface units in conjunction with  
said processor units perform data transfer between said  
memory units and said host computer and said disk  
interface units in conjunction with said processor

units perform data transfer between said memory units  
and said disk drive equipment,

wherein a data transfer method,

which;, in reliable data transfer in which, when

5 data is transferred from an initiator to a target,  
the data received by said target is checked for a  
communication error by using an error check code  
attached to said data, a transfer status

indicating whether said communication error  
10 occurs is returned from said target to said  
initiator, and, if a transfer error occurring  
during said data transfer is detected by said  
transfer status, said initiator retries to  
transfer said data to said target,

15 is for logical records that are units of said  
data transfer between said initiator and said  
target, whereby:

a plurality of said logical records in a block  
are batch transferred;

20 said initiator confirms said transfer status at  
every said batch transfer;

each said logical record is transferred by a  
transfer request issued by said initiator; and

for each said logical record that meets a  
25 predetermined batch transfer condition, said target  
posts a completion status corresponding to said  
transfer request for said logical record to a  
completion queue existing in said target upon correct

reception of said logical record;;

is applied to data transfer between said plurality of host interface units or said plurality of disk interface units and said memory units.

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11. A disk control unit comprising a plurality of host interface units interfacing with a host computer, a plurality of disk interface units interfacing with disk drive equipment, a plurality of memory units, and a plurality of processor units, wherein said host interface units in conjunction with said processor units perform data transfer between said memory units and said host computer and said disk interface units in conjunction with said processor units perform data transfer between said memory units and said disk drive equipment,

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wherein a data transfer method,

which;; in reliable data transfer in which, when data is transferred from an initiator to a target,

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the data received by said target is checked for a communication error by using an error check code attached to said data, a transfer status

indicating whether said communication error occurs is returned from said target to said

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initiator, and, if a transfer error occurring during said data transfer is detected by said transfer status, said initiator retries to transfer said data to said target,

is for logical records that are units of said data transfer between said initiator and said target, whereby:

5 a plurality of said logical records in a block are batch transferred;

said initiator confirms said transfer status at every said batch transfer;

each said logical record is transferred by a transfer request issued by said initiator; and

10 for each said logical record that meets a predetermined batch transfer condition, said target posts a completion status corresponding to said transfer request for said logical record to a completion queue existing in said target upon correct  
15 reception of said logical record;;

is applied to data transfer between said is applied to data transfer between said plurality of host interface units or said plurality of disk interface units and said processor units.

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12. A disk control unit comprising a plurality of host interface units interfacing with a host computer, a plurality of disk interface units interfacing with disk drive equipment, a plurality of  
25 memory units, and a plurality of processor units, wherein said host interface units in conjunction with said processor units perform data transfer between said memory units and said host computer and said disk

interface units in conjunction with said processor units perform data transfer between said memory units and said disk drive equipment,

wherein a data transfer method,

5       which;, in reliable data transfer in which, when data is transferred from an initiator to a target, the data received by said target is checked for a communication error by using an error check code attached to said data, a transfer status  
10       indicating whether said communication error occurs is returned from said target to said initiator, and, if a transfer error occurring during said data transfer is detected by said transfer status, said initiator retries to  
15       transfer said data to said target, is for logical records that are units of said data transfer between said initiator and said target, whereby:

20       a plurality of said logical records in a block are batch transferred;

      said initiator confirms said transfer status at every said batch transfer;

      each said logical record is transferred by a transfer request issued by said initiator; and

25       for each said logical record that meets a predetermined batch transfer condition, said target posts a completion status corresponding to said transfer request for said logical record to a

completion queue existing in said target upon correct reception of said logical record;;

is applied to data transfer between said  
is applied to data transfer between said plurality of  
5 memory units and said plurality of processor units.

13. A disk control unit comprising a plurality  
of host interface units interfacing with a host  
computer, a plurality of disk interface units  
10 interfacing with disk drive equipment, a plurality of  
memory units, and a plurality of processor units,  
wherein said host interface units in conjunction with  
said processor units perform data transfer between said  
memory units and said host computer and said disk  
15 interface units in conjunction with said processor  
units perform data transfer between said memory units  
and said disk drive equipment,

wherein a data transfer method,  
which;; in reliable data transfer in which, when  
20 data is transferred from an initiator to a target,  
the data received by said target is checked for a  
communication error by using an error check code  
attached to said data, a transfer status  
indicating whether said communication error  
25 occurs is returned from said target to said  
initiator, and, if a transfer error occurring  
during said data transfer is detected by said  
transfer status, said initiator retries to

transfer said data to said target,  
is for logical records that are units of said  
data transfer between said initiator and said  
target, whereby:

5           a plurality of said logical records in a block  
are batch transferred;

          said initiator confirms said transfer status at  
every said batch transfer;

          each said logical record is transferred by a  
10       transfer request issued by said initiator; and

          for each said logical record that meets a  
predetermined batch transfer condition, said target  
posts a completion status corresponding to said  
transfer request for said logical record to a  
15       completion queue existing in said target upon correct  
reception of said logical record;;

          is applied to data transfer between said  
is applied to data transfer across said plurality of  
memory units.

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14. A disk control unit comprising a plurality  
of host interface units interfacing with a host  
computer, a plurality of disk interface units  
interfacing with disk drive equipment, a plurality of  
25       memory units, and a plurality of processor units,  
wherein said host interface units in conjunction with  
said processor units perform data transfer between said  
memory units and said host computer and said disk

interface units in conjunction with said processor units perform data transfer between said memory units and said disk drive equipment,

wherein a data transfer method,

5       which;, in reliable data transfer in which, when data is transferred from an initiator to a target, the data received by said target is checked for a communication error by using an error check code attached to said data, a transfer status  
10       indicating whether said communication error occurs is returned from said target to said initiator, and, if a transfer error occurring during said data transfer is detected by said transfer status, said initiator retries to  
15       transfer said data to said target,  
is for logical records that are units of said data transfer between said initiator and said target, whereby:

20       a plurality of said logical records in a block are batch transferred;

      said initiator confirms said transfer status at every said batch transfer;

      each said logical record is transferred by a transfer request issued by said initiator; and

25       for each said logical record that meets a predetermined batch transfer condition, said target posts a completion status corresponding to said transfer request for said logical record to a



completion queue existing in said target upon correct reception of said logical record;;

is applied to data transfer between said  
is applied to data transfer across said plurality of  
5 processor units.